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THE MONTANE BUTTERFLY FAUNA OF THE SPRING RANGE, NEVADA

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ABSTRACT. The butterflies of the Spring Range in southern Nevada show complex biogeographical relationships and several features of an insular fauna. The range is at the southern end of a series of north-south mountain ranges of the Great Basin, is the highest in the Mojave Desert and is near the boundary of the hot southern and cool northern deserts. Five of its 80 butterfly taxa are endemic; the remaining taxa show affinities towards the Great Basin and Rocky Mountains among the truly montane species. There is also considerable impoverishment not only in total species number when compared to areas of the Sierra Nevada and Rocky Mountains but also in number of montane species.

The Spring Range in southern (Clark Co.) Nevada is of considerable biogeographic interest. It marks the southern terminus of the high elevation series of Great Basin mountain masses, is geographically isolated from other ranges of similar mass and elevation by some 80 mi of mostly low elevation desert, is the highest elevation range in the Mojave Desert and is located near the blend zone of the hot Mojave and cool Great Basin deserts. The Spring Range is relatively well known biologically with major works published on its plants and zonation of vegetation (Clokey, 1951; Bradley & Deacon, 1965, Beatley 1976), birds (van Rossem, 1936; Johnson, 1965) and mammals (Hall, 1946). There is no formal account of its butterfly fauna although the range has been visited by numerous collectors since at least the 1920's (Garth, 1928). The butterflies of the range are now sufficiently well known for analysis.

This paper presents a list of the butterfly fauna of the Spring Range, examines its affinities and discusses the montane species in relation to the insular nature of the area. Throughout, a montane species is one which is restricted to the higher elevations and is not (or very rarely) resident in the desert valleys. A more detailed account of the entire Clark Co. butterfly fauna will be published separately.

Description of Area

The Spring Range rises from the valley floor at about 2000 ft to an elevation of 11,910 ft at Charleston Peak. The vegetation at the lower elevations to about 6000 ft is desert scrub dominated by creosote bush (*Larrea tridentata*) and burrobush (*Ambrosia dumosa*) on the lower slopes and blackbush (*Coleogyne ramosissima*) on the higher bajadas. Between 6000 and 7500 ft is a woodland dominated by Piñon (*Pinus monophylla*) and juniper (*Juniperus osteosperma*). Above this is forest dominated by ponderosa pine (*Pinus ponderosa*) and white fir (*Abies concolor*) at lower elevations and limber and bristlecone pines (*Pinus flexilis* and *P. aristada*) at the higher elevations. On the higher ridges are areas of dry meadow. There are few openings in the forest except for areas cleared by man (e.g., Lee Canyon ski area, the old ski run in Kyle Canyon), a small dry meadow in Lee Canyon, and areas disturbed by fire or snow slides. Permanent and semi-permanent water are limited to such areas as upper Kyle Canyon, Deer Creek Canyon and in the Willow and Cold creeks area. In certain areas, especially on the southeast slope, the zonation of vegetation is considerably depressed in cool canyons.

The Fauna

Eighty species of butterflies have been recorded above 6000 ft in the Spring Range of which at least 56 are resident. Thirty-two of these are considered montane taxa (Tables 1, 2). The total number of species compares favorably with other Great Basin mountain ranges (Table 3) especially considering that the latter have not been studied as intensively, for the most part, as the Spring Range. The total falls far short of those for areas within the Rocky Mountain or Sierra Nevada systems.

Endemism

Five subspecies of butterflies are endemic (or nearly so) to the Spring Range. All are quite distinctive. *Speyeria zerene carolae* (considered by some to be a *S. coronis* (Behr) subspecies; authors of Spring Range taxa given in Tables 1, 2) appears to have no close relatives. *Euphydryas anicia morandi* likewise has no apparent close relationship to other *anicia* populations. *Limenitis weidemeyerii nevadae* also occurs in the nearby Sheep Range and probably evolved from an isolate of the narrow-banded southern Rocky Mountain population, *L. w. angustifascia* (Barnes & McDunnough). No intermediate populations have been found although *L. w. angustifascia* and the Great Basin population *L. w. latifascia* Perkins & Perkins appear to blend widely in southern Utah and eastern Nevada. The recently described (Austin, 1980) *Plebejus shasta charlestonensis* is the most distinct of the *shasta* subspecies and is probably allied more closely with the Great Basin populations of *P. s. minnehaha* (Scudder) than with nominate *shasta* (Edwards) of the Sierras. Relationships of the undescribed *Euphilotes enoptes* (Boisduval) population are unclear and require further study.

Certain other Spring Range populations (e.g., *Papilio rutulus*, *Plebejus icarioides evius*, *Coenonympha ochracea brenda* are somewhat

TABLE 1. The resident butterfly fauna (above 6000 ft) of the Spring Range, Nevada and its relationship to other montane areas.

Spring Range Taxon	Sierra Nevada	Great Basin	Rocky Mountain	Biogeographical Affinity[1]
Hesperia comma harpalus (Edwards)*[2]	*yosemite*[3]	X[4]	*susanae*+[5]	GB
Hesperia nevada (Scudder)*	X	X	X	WNA
Hesperia juba (Scudder)*	X	X	X	WNA
Pholisora alpheus oricus Edwards	—	X	*alpheus*	GB
Heliopetes ericetorum (Boisduval)	(L)[6]	(L)	X	WNA
Pyrgus scriptura (Boisduval)	X	—	X	WNA
Pyrgus communis (Grote)	X	X	X	WS
Erynnis brizo burgessi (Boisduval & Le Conte)*	—	—	X	RM
Erynnis meridianus meridianus (Bell)*	—	—	(L)	SWD
Papilio bairdii Edwards*	X	X	X	WNA
Papilio rutulus Lucas*	X	X	X	WNA
Neophasia menapia menapia (Felder & Felder)*	*tau*	X	X	RM
Pieris beckerii beckerii Edwards	X	X	X	WNA
Pieris sisymbrii elivata (Barnes & Benjamin)*	*sisymbrii*	X	X	RM
Pieris protodice protodice Boisduval & Le Conte	X	X	X	WS
Pieris rapae (Linnaeus)	X	X	X	WS
Colias eurytheme eurytheme Boisduval	X	X	X	WS
Anthocaris sara thoosa Scudder*	*sara*+	X+	*julia*	MD
Euchloe hyantis lotta (Beutenmuller)	*hyantis*	X	X	RM
Apodemia mormo mormo (Felder & Felder)	(L)+	X	(L)+	GB
Satyrium behrii behrii (Edwards)*	X	*crossi*	*crossi*	SN
Callophrys fotis fotis (Strecker)*	*windi*	X	*C. mossi*	GB
Callophrys spinetorum (Hewitson)*	X	X	X	WNA
Callophrys siva siva (Edwards)*	—	undes. ssp.	X	RM
Callophrys sheridanii comstocki Henne	*lemberti*	*neoperplexa*	*sheridanii*	MD
Atlides halesus corcorani Gunder	(L)	(L)	(L)	SWD
Strymon melinus pudica (Edwards)	X	X+	*franki*	SWD
Brephidium exilis (Boisduval)	(L)	(L)	(L)	T

Leptotes marina (Reakirt)	(L)	(L)	(L)	T
Hemiargus ceraunus gyas (Edwards)	—	—	—	SWD
Hemiargus isola alce (Edwards)	X	(L)	X	WS
Plebejus icarioides evius (Boisduval)*	*icarioides*+	*ardea*	*lycea*+	SCM
Plebejus shasta charlestonensis Austin*	*shasta*	*minnehaha*	*pitkinensis*	E
Plebejus acmon texanus Goodpasture	*acmon*	(L)+	*lutzi*	SWD
Everes amyntula (Boisduval)*	X	X	X	WNA
Euphilotes enoptes (Boisduval) ssp.*	*enoptes*	*ancilla*	*ancilla*	E
Glaucopsyche lygdamus oro Scudder*	*incognitus*	X	X	RM
Celastrina argiolus cinerea (Edwards)*	*echo*	*echo*	X	RM
Limenitis weidemeyerii nevadae (Barnes & Benjamin)*	*latifascia*(L)	*latifascia*	*angustifascia*+	E
Adelpha bredowii eulalia (Doubleday)*	*californica*	(L)	X	SWD
Vanessa atalanta rubria (Fruhstorfer)	X	X	X	WS
Vanessa virginiensis (Drury)	X	X	X	WS
Vanessa cardui (Linnaeus)	X	X	X	WS
Vanessa annabella (Field)	X	X	X	WNA
Nymphalis californica (Boisduval)*	X	X	X	WNA
Nymphalis milberti furcillata (Say)*	X	X	X	WNA
Nymphalis antiopa antiopa (Linnaeus)	X	X	X	WS
Polygonia satyrus (Edwards)	X	X	X	WS
Polygonia zephyrus (Edwards)*	X	X	X	WNA
Chlosyne palla vallismortis (Johnson)*	*whitneyi*+	—	*flavula*+	MD
Thessalia leanira alma (Strecker)*	—	X	*T. fulvia*	GB
Poladryas minuta arachne (Edwards)*	*monache*	(L)	X	RM
Euphydryas anicia morandi Gunder*	—	*wheeleri*+	*eurytion*+	E
Speyeria zerene carolae dos Passos & Grey*	*zerene*+	*platina*+	*cynna*	E
Coenonympha ochracea brenda Edwards*	*C. ampelos*	X	*ochracea*	GB
Cercyonis sthenele (Boisduval) ssp.*	*silvestris*	*paulus*	*masoni*	MD

[1] GB = Great Basin, WNA = Western North America, WS = Widespread, RM = Rocky Mountain, SWD = Southwest Deserts, MD = Mojave Desert, SN = Sierra Nevada, T = Tropical, SCM = Southern California Mediterranean, E = Endemic.
[2] * = montane taxon.
[3] Names refer to other subspecies or closely related species that are present in the fauna.
[4] X = same taxon present as in the Spring Range.
[5] + = another, less widespread, subspecies of the species is also present in the fauna.
[6] (L) = occurs very locally in this fauna or occurs marginally with center of distribution in another fauna.

TABLE 2. Non-resident butterfly species occurring at the higher elevations (above 6000 ft) of the Spring Range, Nevada.

Megathymus yuccae navajo Skinner	*Phoebis sennae marcellina* (Cramer)
Lerodea eufala (Edwards)	*Eurema nicippe* (Cramer)
Ochlodes yuma (Edwards)	*Nathalis iole* Boisduval
Polites draco (Edwards)	*Ministrymon leda* (Edwards)
Hylephila phyleus (Drury)	*Lycaena dorcas castro* (Reakirt)
Copaeodes aurantiaca (Hewitson)	*Libytheana bachmanii larvata* (Strecker)
Pholisora libya libya (Scudder)	*Precis coenia* (Hubner)
Thorybes pylades (Scudder)	*Chlosyne californica* (Wright)
Battus philenor philenor (Linnaeus)	*Phyciodes mylitta mylitta* (Edwards)
Papilio rudkini Comstock	*Danaus plexippus plexippus* (Linnaeus)
Papilio indra martini Emmel & Emmel	*Danaus gilippus strigosus* (Bates)
Colias cesonia (Stoll)	*Coenonympha california california* Westwood

divergent from other populations but may not be distinctive enough to warrant formal taxonomic recognition. The population of *Chlosyne palla* (Boisduval) also deserves mention here. It appears very close to *C. p. vallismortis* known elsewhere only from the Panamint Mountains in the Death Valley region of California, some 80 mi W of the Spring Range.

The butterflies of the Spring Range thus show one feature of insularity, endemism. Of the resident taxa, 8.9% are endemic. This level of endemism appears unparalleled elsewhere in the Great Basin and places the Spring Range in a class that few other continental areas can rival. Endemism in the Spring Range is also known for other groups. Plants exhibit about 5% endemism at the higher elevations (Clokey, 1951) and 2 of 34 mammals are endemic (5.9%, Hall, 1946). Endemism among plants is greater in the Spring Range than in any other range studied in the Great Basin (Harper et al., 1978). Four subspecies of birds described from the Spring Range were once thought to be endemic. Three of these, however, are not distinct enough to warrant taxonomic recognition and the other is more widespread than previously thought (Johnson, 1965; Austin & Rea, 1976).

Impoverishment

Another feature of insular biotas is impoverishment. As mentioned above, the Spring Range has a representative number of taxa as compared with other Great Basin ranges but far fewer than areas in the Sierra Nevada or Rocky Mountains. The number of species of other groups (i.e., vascular plants, Harper et al., 1978; boreal mammals and birds, Brown, 1978) is also lower than in either of the main western

TABLE 3. Comparison of the Spring Range, Nevada butterfly fauna with those of other western montane areas.

Locality	Number of species	Number of montane species
Sierra Nevada		
Lake Tahoe area[1]	96	57
Donner Pass[2]	83	57
Yosemite[3]	134	82
Great Basin		
Toiyabe Range, Nevada[4]	77	42
Jarbidge Mts., Nevada[4]	73	44
Snake Range, Nevada[4]	74	43
Stansbury Mts., Utah[5]	69	37
Spring Range, Nevada[6]	80	32
Rocky Mountains		
Wasatch-Unitah area, Utah[5]	119	80
Clear Creek Co., Colorado[7]	124	74

[1] Nevada State Museum, D. Bauer and personal records.
[2] Emmel & Emmel, 1962, 1974.
[3] Garth & Tilden, 1963.
[4] Nevada State Museum and personal records.
[5] Tidwell & Callaghan, 1972.
[6] This study.
[7] Brown et al., 1957.

ranges and about intermediate among several Great Basin ranges that have been studied. The impoverishment among butterflies is particularly striking when montane species are considered (Table 3). The Spring Range is inhabited by far fewer montane species than not only the Rockies and Sierras but also the various ranges of the Great Basin.

This impoverishment results from a poor representation of large genera and the absence of certain widespread montane species. The Spring Range has but one *Speyeria*, a *zerene* subspecies. Most other western ranges have in addition at least representatives of *coronis*, *callippe* (Boisduval) and *egleis* (Behr). The genus *Phyciodes* is absent (only 2 records of *mylitta*). Coppers are also absent from the Spring Basin except for one old record of *L. dorcas*. Other Great Basin ranges often have *L. arota* (Boisduval), *L. nivalis* (Boisduval) and *L. heteronea* Boisduval. Other widespread montane taxa which are absent from the Spring Range include *Papilio zelicaon* Lucas, *P. multicaudatus* Kirby, *Euchloe ausonides* Lucas, *Chlosyne acastus* (Edwards), *Euphydryas editha* (Boisduval), *Callophrys eryphon* (Boisduval), *Plebejus saepiolus* (Boisduval) and *Glaucopsyche piasus* (Boisduval).

Impoverishment probably is due to several mechanisms. Extinction may play a role (as is possible with *Lycaena dorcas* cited above). Distance from source populations also may be important. The few records of such species as *Coenonympha california* (one record), *Phy-*

ciodes mylitta (two records), *Lycaena dorcas* (one record) and *Thorybes pylades* (two records) suggest that occasional individuals of non-resident species reach the Spring Range as strays (windblown?) but are incapable of establishing themselves because of factors such as low population density, lack of mates and/or low density or absence of suitable foodplants.

The major cause of impoverishment among Spring Range butterflies is undoubtedly related to low habitat diversity as was suggested for birds (Johnson, 1975). Habitat diversity, according to Johnson's (1975) concept takes into account the number of conifer species, extent of riparian vegetation and extent of permanent water. The Spring Range falls toward the lower end in habitat diversity (Johnson, 1975), containing few species of conifers and little permanent water or riparian vegetation. There is also no true development of alpine vegetation on the higher ridges. This poor representation of certain habitats (and their associated plants) has undoubtedly led to the extinction of and/or prevented the establishment of species characteristic of such habitats.

Biogeography

Each resident taxon occurring in the Spring Range was assigned to a biogeographic element based on its distribution (Table 1). Also, in this table, the relationships to other faunas are presented. Where the Spring Range taxon does not occur, the most closely related taxon is named (if one is present). In some areas, more than one closely related subspecies occurs in another fauna. The most widespread is identified and the presence of another is indicated.

Over 40% of the Spring Range butterflies have wide distributions in western North America or beyond (Table 4). Of the remaining taxa, nearly one-third have hot desert affinities either throughout the region or more locally and include both lowland and montane elements. An additional eight taxa have Rocky Mountain affinities and six have primarily Great Basin relationships. Only one taxon is related to the Sierra Nevada fauna.

When the montane species alone are considered, only 28% are widespread (all are western species), 22% are Rocky Mountain, 16% are endemic and 13% are Great Basin. The desert element is considerably less important comprising only 22% of the non-widespread taxa. Other groups of biota show similar relationships. Nearly one-half of the plants are of Great Basin origin (Clokey, 1951). Birds show both Rocky Mountain and Great Basin affinities with almost no Sierra Nevada influence (Johnson, 1965).

TABLE 4. Biogeographic relationships of the resident butterfly fauna (above 6000 ft) of the Spring Range, Nevada.

Biogeographical element	Total fauna (%)	Montane fauna (%)
Widespread	17.9	0.0
Western North America	23.2	28.1
Tropical	3.6	0.0
So. California Mediterranean	1.8	3.1
Southwestern Desert	10.7	6.3
Mojave Desert	7.1	9.4
Great Basin	10.7	12.5
Rocky Mountain	14.3	21.9
Sierra Nevada	1.8	3.1
Endemic	8.9	15.6
Number of species	56	32

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TWO SECONDARY PARASITOIDS OF THE PUSS MOTH, *MEGALOPYGE OPERCULARIS*

Earlier I reported (Khalaf 1975, Biology of the Puss Caterpillar and its Ichneumonid Parasite, Loyola Univ. Press, New Orleans, Louisiana, 43 p.) that the ichneumonid wasp, *Lymeon orbus* (Say), was a parasite of another ichneumonid, *Lanugo retentor* (Brullé), which, in turn, was a primary parasite of the megalopygid moth, *Megalopyge opercularis* (Smith). Recently, two other wasps were found to be secondary parasites of this moth.

On 30 March 1979, tiny eulophid wasps, *Dimmockia incongrua* (Ashm.), started to emerge in the laboratory from a cocoon of *Megalopyge,* which was obtained a few days earlier from New Orleans. The wasps emerged by eating one tiny hole about 1 mm in diameter in the shell of the cocoon. Thirty females and 2 males were recovered. Dissection of the cocoon revealed that the *Dimmockia* developed within the larval cell of *Lanugo retentor* (Brulle), a primary parasite of the moth. The *Lanugo* larva walled off the host *Megalopyge* prepupa, and then it was parasitized by *Dimmockia*, which caused the death of the *Lanugo* larva. Several brownish yellow pupal skins of the hyperparasite were left behind within the *Lanugo* cell.

A eupelmid wasp, *Arachnophaga aureicorpus* (Girault), emerged on 5 April 1979 from a *Megalopyge* cocoon that was collected in New Orleans in March 1979. The parasitized cocoon lacked the typical hard and tough texture of a finished cocoon; this lack is a symptom of tachinid fly parasitism, which inhibits the *Megalopyge* prepupa from reinforcing the cocoon, which causes the cocoon to harden. The emergence hole was 1.4 mm in diameter and was in a *Lanugo* cell containing a dead adult. Multiparasitism existed between *Lanugo* and tachinid flies before the eupelmid wasp attack. The *Lanugo* larva had walled off the *Megalopyge* prepupa and two tachinid puparia. No special cell was seen which might have belonged to the eupelmid wasp. This is a case of hyperparasitism following multiparasitism.

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